

**REMARKS**

Claims 11 to 21 are now pending. No new matter has been added.

Applicants respectfully request reconsideration of the present application in view of this response.

Applicants thank the Examiner for considering Applicant's earlier remarks.

Claims 11 to 15 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 5,999,285 to Brandt et al. ("Brandt reference") in view of U.S. Patent No. 5,307,410 to Bennett ("Bennett reference").

As discussed in Applicants' last response, the Brandt reference purportedly concerns a quantum key distribution employing non-orthogonal quantum states to distribute a random bit sequence between two users for use as a provably secure key for encryption and authentication. Abstract, lines 1-4. The Brandt reference refers to a key generation procedure involving the transmission, interception, and reception of two nonorthogonal photon polarization states, where at the receiving end, a positive-operator-valued measure is employed in the measurement process. Abstract, lines 4-8. The Brandt reference states that the "invention is a receiver that is an all-optical realization of the [positive-operator-valued measure] and includes a Wollaston prism, a mirror, two beam splitter, a polarization rotator, and three photodetectors. Abstract, lines 8-11.

The Bennett reference purportedly concerns an apparatus and method for overcoming the problem of distributing fresh cryptographic key information between two users who share no secret information initially. Abstract, lines 11-14. The Bennett reference refers to an apparatus and method for sending messages unintelligible to an eavesdropper comprising a plurality of n communication nodes, each having a first, second and third port, a first quantum channel for conveying dim and reference light pulses connected to the first port of the plurality of communication nodes, a second timing channel for conveying timing signals connected to the second port of the plurality of communication nodes, a third message channel for conveying information selected from the group consisting of plain text and encrypted text connected to the third port of the plurality of communication nodes. Col. 2, lines 41-53. The Bennett reference further refers to at least one of the communication nodes including a first source of coherent light pulses and one or more beam splitters for sending a plurality of dim light pulses of coherent light of an intensity less than one expected photon per dim pulse spaced apart in time over the first quantum channel, a second source of

coherent light pulses for sending a plurality of reference light pulses of coherent light positioned in time with respect to the plurality of dim light pulses over the first quantum channel, a random number generator for generating random numbers, a phase modulation coupled to the first source of coherent light pulses and one or more beam splitters and to the random number generator for setting the phase of the plurality of dim light pulses. Col. 2, lines 41-68.

In contrast to both the Brandt and Bennett references, claim 11 of the present application recites a method of generating a binary sequence of random numbers based on random selection of a path of photons on a beam splitter, including the features of:

emitting photons or photon swarms according to a randomness principle using a photon source, the photon source *including a low power light source*;

*splitting the photons or photon swarms emitted by the photon source during a measurement period using at least a first beam splitter and a second beam splitter disposed in a beam path of the light source, the second beam splitter being disposed downstream of the first beam splitter in a first downstream path of the first beam splitter;*

*detecting, in accordance with the splitting, the photons or photon swarms from the splitting using a first, a second and a third detector connected to a detection device, the first detector being disposed in a second downstream path of the first beam splitter, the second detector being disposed in a third downstream path of the second beam splitter, the third detector being disposed in a fourth downstream path of the second beam splitter;*

*generating a random number when the photons or photon swarms detected at the first, second and third detectors together correspond to a predefined photon scheme, the photon scheme including generating a random number when only one of the second and third detectors registers a detection of the photons or photon swarms.*

The Brandt reference and Bennett reference do not, alone or in combination, teach or suggest the features of claim 14 (which depends from claim 11). The Brandt reference refers to its invention being a physical realization for a positive-operator-valued measure (a.k.a. probability operator valued measure) as shown in Fig. 1. Col. 4, lines 46-49. The Brandt reference suggests that, in Fig. 1, the straight lines with arrows represent possible optical pathways for a photon to move through the device 10, with reference numbers 22, 24 and 26 designating photodetectors which represent the measurement operators, and a Wollaston prism 28 which is aligned so that an incident photon with polarization vector would take a particular path and not another. Col. 4, lines 49-60. The device 10 also has two beam splitters, where beam splitter 32 is a 50/50 beam splitter for a photon entering either of its entrance ports; the Brandt reference also includes a mirror 36. Col. 5, lines 1-7. The Brandt device requires precise phase alignment in the circuit. Col. 6, lines 54-57. The Brandt

reference does not describe or suggest the photon source including a low power light source; splitting the photons or photon swarms emitted by the photon source during a measurement period using at least a first beam splitter and a second beam splitter disposed in a beam path of the light source, the second beam splitter being disposed downstream of the first beam splitter in a first downstream path of the first beam splitter; and generating a random number when the photons or photon swarms detected at the first, second and third detectors together correspond to a predefined photon scheme, the photon scheme including generating a random number when only one of the second and third detectors registers a detection of the photons or photon swarms, as in claim 11.

The Bennett reference does not describe or suggest the elements lacking in the Brandt reference, nor does the reference describe or suggest implementing such elements in the manner claimed in claim 11. Instead, the Bennett reference concerns sending messages unintelligible to an eavesdropper comprising a plurality of n communication nodes, each having a first, second and third port, a first quantum channel for conveying dim and reference light pulses connected to the first port of the plurality of communication nodes, a second timing channel for conveying timing signals connected to the second port of the plurality of communication nodes, a third message channel for conveying information selected from the group consisting of plain text and encrypted text connected to the third port of the plurality of communication nodes. The Bennett reference refers to using both dim light pulses and coherent light pulses, in contrast to claim 11. The Bennett reference does not teach or suggest the features of claim 11, including splitting the photons or photon swarms emitted by the photon source during a measurement period using at least a first beam splitter and a second beam splitter disposed in a beam path of the light source, the second beam splitter being disposed downstream of the first beam splitter in a first downstream path of the first beam splitter; and generating a random number when the photons or photon swarms detected at the first, second and third detectors together correspond to a predefined photon scheme, the photon scheme including generating a random number when only one of the second and third detectors registers a detection of the photons or photon swarm. Further, Applicants respectfully submit that it would not have been obvious to one of ordinary skill in the art at the appropriate time.

Claims 12 to 14 depend from claim 11 and are allowable for at least the same reasons as claim 11. Claim 15 recites features analogous to those of claim 11 and is thus allowable for essentially the same reasons as claim 11.

Accordingly, Applicants respectfully submit that claims 11 to 15 are allowable over the Brandt and Bennett references; and, withdrawal of the rejection of claims 11 to 15 under 35 U.S.C. § 103(a) over the Brandt reference in view of the Bennett reference is respectfully requested.

Claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as unpatentable over the Brandt reference in view of U.S. Patent No. 5,966,224 to Hughes et al. ("Hughes reference").

As discussed above, the Brandt reference purportedly concerns a quantum key distribution employing non-orthogonal quantum states to distribute a random bit sequence between two users for use as a provably secure key for encryption and authentication. Abstract, lines 1-4. The Brandt reference refers to a key generation procedure involving the transmission, interception, and reception of two nonorthogonal photon polarization states, where at the receiving end, a positive-operator-valued measure is employed in the measurement process. Abstract, lines 4-8. The Brandt reference states that the "invention is a receiver that is an all-optical realization of the [positive-operator-valued measure] and includes a Wollaston prism, a mirror, two beam splitter, a polarization rotator, and three photodetectors. Abstract, lines 8-11.

The Hughes reference purportedly concerns an apparatus and method for secure communication between an earth station and spacecraft, where a laser outputs single pulses that are split into preceding bright pulses and delayed attenuated pulses, and polarized, and a Pockels cell changes the polarization of the polarized delayed attenuated pulses according to a string of random numbers, a first polarization representing a "1," and a second polarization representing a "0." Abstract, lines 1-8. The Hughes reference refers to the receiving station as having a beam splitter which randomly directs the preceding bright pulses and the polarized delayed attenuated pulses onto longer and shorter paths, both terminating in a beam splitter.

Claims 16 and 17 depend from claim 15. In contrast to the Brandt and Hughes references, claim 15 recites an apparatus for generating a binary sequence of random numbers, including the features of:

*a low power light source including a photon source for emitting individual photons and/or photon swarms according to a randomness principle;*  
*a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the*

*light source and the second beam splitter;  
a first detector disposed in a downstream path of the first beam splitter;  
a second detector and a third detector disposed in a first and a second  
downstream path, respectively, of the second beam splitter; and  
a detection device for generating the random numbers, the detection device  
being disposed downstream from the first, second and third detectors, the detection  
device including at least one counter and computer.*

The Brandt reference and Hughes reference do not, alone or in combination, teach or suggest the features of claim 16 or claim 17 (both of which depend from claim 15).

As discussed above, the Brandt reference does not teach or suggest the features of claim 15, including a low power light source including a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device including at least one counter and computer.

The Hughes reference does not describe or suggest the elements lacking in the Brandt reference, nor does the reference describe or suggest implementing such elements in the manner claimed in claim 15. Instead, the Hughes reference appears to concern a system between an earth station and spacecraft, where a laser outputs single pulses that are split into preceding bright pulses and delayed attenuated pulses, and polarized; and a Pockels cell changes the polarization of the polarized delayed attenuated pulses according to a string of random numbers, a first polarization representing a "1," and a second polarization representing a "0." The Hughes reference does not teach or suggest the features of claim 15, including a low power light source having a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device

including at least one counter and computer.

Accordingly, Applicants respectfully submit that claim 15, and thus, claims 16 and 17, are allowable over the Brandt and Hughes references; and, withdrawal of the rejection of claims 16 and 17 under 35 U.S.C. § 103(a) over the Brandt reference in view of the Hughes reference is requested.

Claim 18 was rejected under 35 U.S.C. § 103(a) as anticipated by the Brandt reference in view of U.S. Patent No. 3,575,669 to Haeff et al. (the "Haeff reference").

The Brandt reference purportedly concerns a quantum key distribution employing non-orthogonal quantum states to distribute a random bit sequence between two users for use as a provably secure key for encryption and authentication. Abstract, lines 1-4. The Brandt reference refers to a key generation procedure involving the transmission, interception, and reception of two nonorthogonal photon polarization states, where at the receiving end, a positive-operator-valued measure is employed in the measurement process. Abstract, lines 4-8. The Brandt reference states that the "invention is a receiver that is an all-optical realization of the [positive-operator-valued measure] and includes a Wollaston prism, a mirror, two beam splitter, a polarization rotator, and three photodetectors. Abstract, lines 8-11.

The Haeff reference purportedly concerns an apparatus and process for achieving amplification of radiation from an excited, chemically reacting mixture by initiating chemical reaction of the mixture adjacent to an optical cavity and quickly flowing the mixture transversely through the cavity while the radiation interacts with the excited molecules of the mixture. Abstract. The Haeff reference refers to tuning and focusing the optical cavity or the reflection chamber by varying the placement and curvature of cavity defining reflectors. The Haeff reference further refers to removing output light energy from the optical cavity by a separate reflector selectively moveable into the path of the reflecting radiation. Abstract.

Claim 18 depends from claim 15. Claim 15 recites an apparatus for generating a binary sequence of random numbers, including the features of:

*a low power light source including a photon source for emitting individual photons and/or photon swarms according to a randomness principle;*  
*a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the*

*light source and the second beam splitter;  
a first detector disposed in a downstream path of the first beam splitter;  
a second detector and a third detector disposed in a first and a second  
downstream path, respectively, of the second beam splitter; and  
a detection device for generating the random numbers, the detection device  
being disposed downstream from the first, second and third detectors, the detection  
device including at least one counter and computer.*

The Brandt reference and Haeff reference do not, alone or in combination, teach or suggest the features of claim 18 (which depends from claim 15).

As discussed above, the Brandt reference does not teach or suggest the features of claim 15, including a low power light source including a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device including at least one counter and computer.

The Haeff reference does not describe or suggest the elements lacking in the Brandt reference, nor does the reference describe or suggest implementing such elements in the manner claimed in claim 15. Instead, the Haeff reference appears to concern achieving amplification of radiation from an excited, chemically reacting mixture by initiating chemical reaction of the mixture adjacent to an optical cavity and quickly flowing the mixture transversely through the cavity while the radiation interacts with the excited molecules of the mixture. In fact, the Haeff reference refers to tuning and focusing the optical cavity or the reflection chamber by varying the placement and curvature of cavity defining reflectors; and, removing output light energy from the optical cavity by a separate reflector selectively moveable into the path of the reflecting radiation. The Haeff reference does not teach or suggest the features of claim 15, including a low power light source having a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second

downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device including at least one counter and computer.

Accordingly, Applicants respectfully submit that claim 15, and thus, claim 18, is allowable over the Brandt and Haeff references; and, withdrawal of the rejection of claim 18 under 35 U.S.C. § 103(a) over the Brandt reference in view of the Haeff reference is requested.

Claims 19 to 21 were rejected under 35 U.S.C. § 103(a) as anticipated by the Brandt reference in view of U.S. Patent No. 5,323,010 to Gratton et al. (the "Gratton reference").

Claims 19 to 21 depend from claim 15. Claim 15 recites an apparatus for generating a binary sequence of random numbers, including the features of:

*a low power light source including a photon source for emitting individual photons and/or photon swarms according to a randomness principle;*  
*a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter;*  
*a first detector disposed in a downstream path of the first beam splitter;*  
*a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and*  
*a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device including at least one counter and computer.*

The Brandt reference and Gratton reference do not, alone or in combination, teach or suggest the features of claims 19 to 21 (both of which depend from claim 15).

As discussed above, the Brandt reference does not teach or suggest the features of claim 15, including a low power light source including a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection

device including at least one counter and computer.

The Graton reference does not describe or suggest the elements lacking in the Brandt reference, nor does the reference describe or suggest implementing such elements in the manner claimed in claim 15. Instead, the Graton reference appears to concern cross-correlation frequency domain fluorometry-phosphorimetry involving a source of electromagnetic radiation and a means for amplitude modulating the radiation at the first frequency. The Graton reference states that the amplitude modulated radiation is directed at a sample, while an optical array detector measures the resulting luminescence of the sample. The Graton reference does not teach or suggest the features of claim 15, including a low power light source having a photon source; a first and a second beam splitter disposed downstream from the light source in a beam path of the light source, the first beam splitter being disposed between the light source and the second beam splitter; a first detector disposed in a downstream path of the first beam splitter; a second detector and a third detector disposed in a first and a second downstream path, respectively, of the second beam splitter; and a detection device for generating the random numbers, the detection device being disposed downstream from the first, second and third detectors, the detection device including at least one counter and computer.

Accordingly, Applicants respectfully submit that claim 15, and thus, claims 19 to 21, are allowable over the Brandt and Graton references; and, withdrawal of the rejection of claims 19 to 21 under 35 U.S.C. § 103(a) over the Brandt reference in view of the Graton reference is requested:

To reject a claim as obvious under 35 U.S.C. § 103, the prior art must disclose or suggest each claim element and it must also provide a motivation or suggestion for combining the elements in the manner contemplated by the claim. (See Northern Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 934 (Fed. Cir. 1990), cert. denied, 111 S. Ct. 296 (1990); In re Bond, 910 F.2d 831, 834 (Fed. Cir. 1990)).

The Federal Circuit in the case of In re Kotzab has made plain that even if a claim concerns a "technologically simple concept" – which is not even the case here, there still must be some finding as to the "specific understanding or principle within the knowledge of a skilled artisan" that would motivate a person having no knowledge of the claimed subject matter to "make the combination in the manner claimed," stating that:

In this case, the Examiner and the Board fell into the hindsight trap. The idea of a single sensor controlling multiple valves, as opposed to multiple sensors controlling multiple valves, is a technologically simple concept. *With this simple concept in mind, the Patent and Trademark Office found prior art statements that in the abstract appeared to suggest the claimed limitation. But, there was no finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of Kotzab's invention to make the combination in the manner claimed.* In light of our holding of the absence of a motivation to combine the teachings in Evans, we conclude that the Board did not make out a proper *prima facie* case of obviousness in rejecting [the] claims . . . under 35 U.S.C. Section. 103(a) over Evans.

(See *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1318 (Federal Circuit 2000) (citations omitted, italics in original, emphasis added)). Here again, there have been no such findings.

In addition, with respect to the above-identified application, Applicants respectfully request some sort of evidence and/or affidavit from the Patent Office regarding the Patent Office's assertions of what it suggests is obvious to one of ordinary skill in the art.

No motivation or suggestion for combining the elements in the manner contemplated by claims 11 to 21 is shown in any of the cited references, alone or in combination.

In summary, it is respectfully submitted that all of claims 11 to 21 are allowable for the foregoing reasons.

#### CONCLUSION

In view of all of the above, it is believed that any rejections of the claims as well as the rejections of claims 11 to 21 have been obviated, and that claims 11 to 21 are allowable. It is therefore respectfully requested that those objections and rejections be withdrawn, and that the present application issue as early as possible.

If a telephone interview would assist in furtherance of allowance of the present application, the Examiner is encouraged to contact the undersigned at the number below.

Dated: July 6, 2004

Respectfully submitted,

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